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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/604,487	07/25/2003	Hendrik F. Hamann	FIS920020166US1	1486

32074 7590 09/22/2005

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EXAMINER	
ARANCIBIA, MAUREEN GRAMAGLIA	
ART UNIT	**PAPER NUMBER**
1763	

DATE MAILED: 09/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/604,487	HAMANN ET AL.	
	Examiner	Art Unit	
	Maureen G. Arancibia	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 June 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3,4,7-9,11,14 and 17-31* is/are pending in the application.

4a) Of the above claim(s) *17-30* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3,4,7-9,11,14 and 31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. The objection to Claims 1, 3, 4, 7-9, 11, and 14 is withdrawn in view of Applicant's identification of Figures 4-8 as illustrating the scope of the terms "local" and "proximate," and in view of the amendment to Claim 1 to recite that the target feature is a pattern on an integrated circuit substrate.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 3, 11, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,316,153 to Goodman et al. in view of U.S. Patent 6,407,001 to Scott.

Goodman et al. teaches a method for altering a feature on a substrate, comprising: locally delivering a chemical to a site proximate to the target feature (Column 8, Lines 59-61), and providing activating energy at said site by illuminating a probe tip (the tip of a pipette barrel), thereby creating near-field radiation. (Column 8, Lines 28-37 and 61-62) A chemical reaction takes place, resulting in alteration of the surface feature. (Column 9, Line 9 - Column 12, Line 8)

Goodman et al. does not expressly teach that the target feature is a surface feature of an existing pattern on an integrated circuit substrate (IC), or that the feature and pattern are made of copper, as recited in Claim 31.

Scott teaches a method of reacting and milling a copper target feature 130 of an existing copper pattern on an IC, including providing activating energy at a site proximate to the feature. (Figures 2 and 3; Column 3, Line 47 - Column 4, Line 8)

It would have been obvious to one of ordinary skill in the art to use the method of Goodman et al. to react and mill a copper target feature of an existing pattern on an IC, as taught by Scott. The motivation for doing so, as taught by Scott (Column 2, Lines 58-67), would have been to perform testing and debugging of a copper integrated circuit.

In regards to Claim 3, Goodman et al. teaches that the local delivery is performed by passing said chemical through a probe tip channel (a barrel of the multiple-barrel pipette) having an opening placed proximate to said site. (Column 8, Lines 59-61)

In regards to Claim 11, Goodman et al. teaches that a second chemical can be provided for assisting in said reaction. (Column 9, Lines 1-5)

4. Claims 1, 3, 11, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,397,420 to Sakakibara et al. in view of Scott.

Sakakibara et al. teaches an embodiment of a method for altering a feature on a substrate, comprising: locally delivering a chemical 50 to a site proximate to the target feature (Column 8, Lines 20-23; Figure 9A), and providing activating energy at said site

via a probe tip. (Figures 9A and 10; Column 8, Lines 15-26) Milling takes place, resulting in alteration of the surface feature. (Column 8, Lines 27-31)

Sakakibara et al. does not expressly teach that this embodiment comprises providing the activating energy by illuminating the probe tip.

However, Sakakibara et al. teaches another embodiment of a processing method, comprising providing the activating energy by illuminating a probe tip 71 with coherent (*laser*) radiation from source 70. (Figure 3; Column 5, Lines 53-66)

It would have been obvious to one of ordinary skill in the art to combine the two embodiments taught by Sakakibara et al. to supply the activating energy by illuminating the probe tip with coherent radiation. The motivation for making this combination, as taught by Sakakibara et al. (Column 5, Line 67 - Column 6, Line 4), would have been to simultaneously produce a plasma to dissociate a reactive gas and emit a laser beam to promote reaction between the reactive gas and the substrate, thereby milling a deep trench.

In regards to Claims 1 and 31, Sakakibara et al. does not expressly teach that the target feature is a surface feature of an existing pattern on an integrated circuit substrate (IC), or that the feature and pattern are made of copper.

Scott teaches a method of reacting and milling a copper target feature 130 of an existing copper pattern on an IC, including providing activating energy at a site proximate to the feature. (Figures 2 and 3; Column 3, Line 47 - Column 4, Line 8)

It would have been obvious to one of ordinary skill in the art to use the method of Sakakibara et al. to react and mill a copper target feature of an existing pattern on an

IC, as taught by Scott. The motivation for doing so, as taught by Scott (Column 2, Lines 58-67), would have been to perform testing and debugging of a copper integrated circuit.

In regards to Claim 3, delivery is performed by passing said chemical through a probe tip channel 23 having an opening placed proximate to the site to be altered. (Figure 9A)

In regards to Claim 11, Sakakibara et al. does not expressly teach that a second chemical is provided for assisting in the reaction.

Scott teaches that a second chemical can be provided for assisting in the reaction and milling of the copper feature 130. (Column 4, Lines 10-24)

It would have been obvious to one of ordinary skill in the art to further modify the combination of Sakakibara et al. and Scott to provide a second chemical for assisting in the reaction. The motivation for doing so, as taught by Scott (Column 4, Lines 18-24), would have been that the second chemical could react with any residual copper after the initial reaction takes place.

5. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Goodman et al. in view of Scott as applied to Claim 1 above, and further in view of U.S. Patent Application Publication 2002/0063212 to Mirkin et al.

The teachings of Goodman et al. and Scott were discussed above.

The combination of Goodman et al. and Scott does not expressly teach that the local delivery of a chemical can be performed by placing a probe tip coated with said chemical proximate to the site to be altered.

Mirkin et al. teaches that local delivery of a chemical can be performed by placing a probe tip (SPM tip) coated with said chemical proximate to a site to be altered. (Paragraph 56 and 79)

It would have been obvious to one of ordinary skill in the art to modify the method taught by Goodman et al. and Scott to deliver the chemical by placing a coated probe tip proximate to the site to be altered, as taught by Mirkin et al. The motivation for doing so, as taught by Mirkin et al. (Paragraph 101), would have been to deliver the chemical on a molecular scale with good resolution.

6. Claims 7, 8, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goodman et al. in view of Scott as applied to Claim 1 above, and further in view of "Strength of Electric Field in Apertureless Near-Field Optical Microscopy" by Martin et al. (IBM Research Report, RC21891 (98484) 11/9/2000; from Applicant's IDS), as evidenced by "Absorption of electromagnetic radiation" by West (AccessScience@McGraw-Hill, http://www.accessscience.com, DOI 10.1036/1097-8542.001600, last modified: March 6, 2001.)

The teachings of Goodman et al. and Scott were discussed above, including Goodman et al.'s teaching of the generation of near-field radiation. (Column 8, Lines 28-37 and 61-62)

The combination of Goodman et al. and Scott does not expressly teach that the probe comprises a non-metal portion and a metal apex portion, causing localized

scattering of photons, or that the illumination wavelength is at least about ten times greater than the diameter of the probe tip apex.

Martin et al. teaches that optical near-field enhancement can be produced by illuminating a gold probe tip mounted on a non-metal probe. (Conclusion, second paragraph) The tip acts as a scatterer. (Conclusion, first line) Martin et al. also teaches that the tip can be hemispherical, with a diameter less than one-thirtieth of the wavelength of the illumination. (D=20 nm, λ=633 nm; "Modified Tips," third paragraph)

It would have been obvious to one of ordinary skill in the art to modify Goodman et al. and Scott to enhance the near-field radiation by generating photon scatter from the probe, as taught by Martin et al. The motivation for using a non-metal probe tipped with a metal apex to cause localized photon scatter, as taught by Martin et al. ("Conclusion," second paragraph), would have been that the different material composition at the tip helps to recover resonance effects, thereby further enhancing the electric field at the tip. The motivation for having the diameter of the tip be less than one-thirtieth of the wavelength of the illumination would have been to avoid the dephasing effects from larger-dimensioned tips. ("Electric field enhancement for real tip systems," second paragraph)

The combination of Goodman et al., Scott, and Martin et al. does not expressly teach that the localized photon scatter imparts thermal energy to the substrate, as recited in Claim 14. Nevertheless, the impact and absorption of the scattered photons would inherently impart thermal energy to the substrate. (See West, first paragraph)

7. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakakibara et al. in view of Scott as applied to Claim 1 above, and further in view of U.S. Patent 6,735,398 to Izadpanah et al.

The teachings of Sakakibara et al. and Scott were discussed above. Sakakibara et al. further teaches that the probe tip comprises two electrodes 21, 32 with a gap 22 there between (Figure 10), and that interaction between the electrodes and the coherent radiation causes formation of a plasma between said electrodes. (Column 9, Lines 20-23)

The combination of Sakakibara et al. and Scott does not expressly teach that the illumination of coherent radiation should comprise coherent radiation of *two* wavelengths.

Izadpanah et al. teaches that pulsed radiation can be obtained by combining the output of two laser sources with different wavelengths (and frequencies). (Column 6, Lines 9-14)

It would have been obvious to one of ordinary skill in the art to further modify the combination of Sakakibara et al. and Scott to create pulsed radiation by combining the output of two laser sources, as taught by Izadpanah et al. The motivation for making such a modification would have been to increase the number of active species formed by providing different frequencies of radiation (corresponding to different excitation frequencies for various chemical species).

Response to Arguments

8. Applicant's arguments filed 30 June 2005 have been fully considered but, to the extent to which they still apply, they are not persuasive.

Specifically, in response to applicant's argument that the combination of references presented in the prior Office Action would not result in a workable process, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

Conclusion

9. Applicant's amendment necessitated any new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maureen G. Arancibia whose telephone number is (571) 272-1219. The examiner can normally be reached on core hours of 10-5, Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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